$H_0: p = 0.50$

$H_a: p \neq 0.50$

Quarters: $(0.48, 0.51)$

Pennies: $(0.493, 0.52)$

$p_Q = p_P$

- want to compare 2 populations
- Each group/pop is distinct
- Responses are independent of each other.

Conf. Int.

Comparing 2 pop. proportions

If 2 prop. are same then $p_1 = p_2$ and $p_1 - p_2 = 0$.

looking @ the difference btw. the 2 pop. prop.
Is it 0? or not?

$p_1 - p_2 = 0$

Generic:

$$\text{statistic} \pm (\text{critical value})\underbrace{\left(\begin{array}{c}\text{std. dev.}\\ \text{of statistic}\end{array}\right)}_{SE}$$

$$(\hat{p}_1 - \hat{p}_2) \pm z^* \underbrace{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}}_{SE}$$

$= (a, b)$

We are ____% confident that the difference between the prop. of __#1__ and __#2__ is btw __a__ and __b__.

Since 0 is in/out of the interval...

2 prop Z Int.

Test

1) Assumptions
2) Hypotheses
3) Test Statistic
4) P-value
5) Conclusion

$p_1 = p_2$

#1	#2
p_1	p_2
* $\hat{p}_1 = \frac{x_1}{n_1}$	$\hat{p}_2 = \frac{x_2}{n_2}$
n_1	n_2

means

$\bar{x}$

n

s

μ

Hyp

$$\boxed{\begin{array}{l} H_0: p_1 = p_2 \\ H_a: p_1 \gtreqless p_2 \;(>, <, \neq) \end{array}}$$

OR

$$p_1 - p_2 = 0$$

$$p_1 - p_2 \;(>, <, \neq)\; 0$$

$$H_0: \mu_1 = \mu_2$$

$$\sigma_1 = \sigma_2$$

T.S. / Generic

$$\frac{\text{statistic} - \text{param.}}{\text{std. dev. of statistic}}$$

$$z = \frac{(\hat{p}_1 - \hat{p}_2)}{\underbrace{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}_{SE}}$$

Ex: $\hat{p}_1 = \frac{70}{100}$

$\hat{p}_2 = \frac{40}{100}$

$$\hat{p} = \frac{X_1 + X_2}{n_1 + n_2} \neq \hat{p}_1 + \hat{p}_2$$

pooled

$\hat{p} = \frac{110}{200}$

- Notice this is not the same as conf int
- Why? Conf. Int doesn't have $H_0: p_1 = p_2$
- b/c of H_0

* no unpooled

P-value

$P(z \geq \underline{\text{test stat}}) = \text{normcdf}($

$z = 2.56$

Conclusion

- We reject/fail to reject Ho .....
- We have sufficient evidence that the prop of ___#1___ is ___$>$ $<$ $=$ $\neq$___ the prop. of ___#2___.

write out

2 prop z test

Assump for interval + test

- 2 independent SRS
- $n_1 \hat{p}_1$
  $n_1(1-\hat{p}_1)$ ≥ 5
  $n_2 \hat{p}_2$
  $n_2(1-\hat{p}_2)$
- $pop_1 \geq 10 \cdot n_1$
  $pop_2 \geq 10 \cdot n_2$

Ex:

$\hat{p}_M = 0.227$

$\hat{p} = 0.1938 \quad \hat{p}_W = 0.1698$

$\alpha = 0.05$

$H_0: p_M = p_F$

$H_a: p_M \neq p_F$

$$z = \frac{\hat{p}_M - \hat{p}_F}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = 9.337$$

$a \cdot P(z > 9.337) = 1.0112 \times 10^{-20}$

State Check

We reject H_0 b/c p-value $< \alpha = 0.05$. We have suff. evid. that the prop. of male binge drinkers is not equal to the prop. of female binge drinkers.

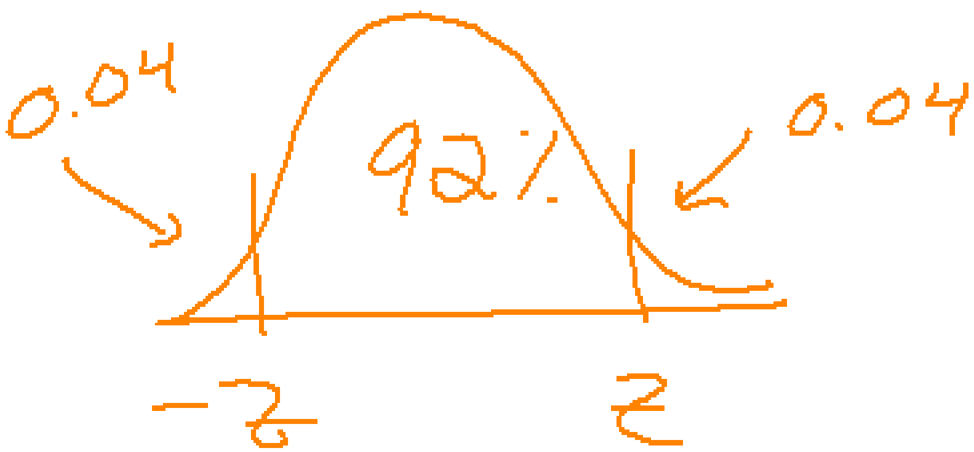
$C = 92\%$

$$(\hat{p}_M - \hat{p}_F) \pm z^* \sqrt{\frac{\hat{p}_M(1-\hat{p}_M)}{n_M} + \frac{\hat{p}_F(1-\hat{p}_F)}{n_F}}$$

$$= (0.04631, 0.06808)$$

We are 92% confident that the difference between the prop. of male & female binge drinkers is btw. 4.631% and 6.808%.

Since 0 is not in the interval, the 2 prop. are not the same.



$z = \text{invnorm}(0.04)$